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ABSTRACT

Based on the general lack of empirical evidence on the effects of word processors on writing quality, a study focused on changes in writing quality and syntax of first-year college writers who were taught to use word processors as part of their English composition class. The issue addressed was whether using word processors increased the syntactic growth or the holistic writing quality of 200 freshman composition students. The subjects were randomly split into word processing and handwriting sections. Both sections were taught in an identical manner other than the mode of writing, with the instruction centering on teacher-student conferences and revision. Students in each group provided two samples of transactional prose before instruction began and after instruction was completed. The sessions during which they produced the samples were run identically. Findings revealed that word processing students' gain in holistic quality was more than five times that of handwriters; word processing students had a mean pretest to posttest gain in overall writing quality of 2.8 points, while handwriting students had a gain of only .54. In addition, word processing students made far greater gains in total words than did handwriters, and length was directly related to essay quality. However, other syntactic variables, such as use of free modification, number of clauses, average number of words per clause, and type of embedding, were not affected by mode of composition. Sixty-four references are provided. (SKC)

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A Comparative Study of the Quality and Syntax of Compositions by First Year College Students Using Handwriting and Word Processing

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In recent years, numerous theorists and researchers have advocated the use of microcomputers in the composition classroom (Burns, 1980; Burns & Culp, 1980; Rodrigues & Rodrigues, 1983; Schwartz, H. J., 1982; Schwartz, M., 1982). Yet there have been few empirical studies undertaken to analyze how the computer effects writing. And those studies that have been undertaken generally have small experimental populations, Bean (1983) and Collier (1983) being representative, thus making generalizations to larger populations suspect. Perhaps more importantly, most studies do not analyze changes in overall writing quality, one of the touchstones to understanding the value of a writing pedagogy or a writing tool such as the microcomputer. Studies by Gerrard (1982), Selfe and Wahlstrom (1983), and Womble (1984) are representative, offering no empirical evidence about change in writing quality.

Hence, many theorists advocate the virtues of computer programs or pedagogical approaches to using the word processor based on supports lacking sufficient warrants (to use Toulmin's terminology). Typically, teachers and students report liking

certain software programs, or thinking that programs help improve writing quality without offering empirical evidence (Cottey, 1982; Macgregor, 1982; Portch & Breininger, 1983; Southwell, 1983). But such anecdotal claims do not seem sufficient to justify the considerable amount of time, effort, and expense required to make microcomputers an integral part of the composition class. As Bridwell, Nancarrow, and Ross (1984) point out, teachers of writing at all educational levels need the results of empirical research to make informed decisions about the appropriate uses of the microcomputer in the classroom. And a central part of that research should focus on changes in writing quality.

Background

Shuy (1981) defined two basic pedagogical approaches to language study--the reductive approach and the holistic approach. In the reductive approach, language is broken down into small, discrete elements which the learner must master. In the context of the writing classroom, this means students master various discrete grammatical elements--typically those found in grammar

handbooks--before students are expected to write competent essays. But in the holistic approach to language, the student begins with a whole piece of writing, mastering elements of the written code as those elements become important for communicating meaning to an audience.

At the present time, the microcomputer is used generally in one of two ways in most writing classrooms. In one approach, computer-assisted instruction (CAI), the microcomputer helps students focus on one or more of the elements of the writing process. Some of the most popular programs focus the writer's attention on heuristics, and there are also various style check programs available. However, this model of computer use often degenerates into the purely reductive approach to writing espoused by current traditional rhetorical theory. When this happens, the microcomputer is turned into an electronic workbook, a high-tech system for drill-and-practice of grammar. Unfortunately, such grammar programs are easy to write, and they abound in the marketplace. But the overwhelming evidence from researchers and theorists suggests that writing instruction based on a reductive view of language is

not productive (Clifford, 1981; Elley, Barham, Lamb, and Wyllie, 1976; Flower and Hayes, 1981; Hartwell, 1985; Macrorie, 1980).

In the other approach, the microcomputer is used as a word processor. This model of computer use typically follows from Shuy's definition of the holistic approach to writing instruction. Proponents of this model claim that the technology of word processing gives students the potential to manipulate text with greater ease than is possible with pen and paper, particularly when revising.

The ease of manipulating text on the word processor is a key point, for many researchers and theorists in composition think that revision is one of the most important elements in the writing process (Britton, Burgess, Martin, McLeod, & Rosen, 1975; Gentry, 1980; Lanham, 1979; Murray, 1976; Perl, 1979). Yet the mechanical drudgery involved in revising text often hinders writers; it takes time and effort to copy and recopy, especially by hand. But the microcomputer, used as a word processor, may serve the composition student well, regardless of whether the revisions relate to the microstructure or the macrostructure of the text (Appleby, 1983;

Cronnell & Humes, 1981; Daiute, 1983; Hennings, 1981; Littlefield, 1983; Perry, 1981; Schwartz, H., 1984; Smith & Gray, 1981).

Removing the hard work involved in recopying text may lead students to undertake what Faigley and Witte (1981) call text-based revision, revision that alters structure and meaning, revision seldom observed in early studies of student writing with pen and paper (Beach, 1976; Bridwell, 1979/1980; Emig, 1971). For example, Bean (1983) found some evidence for text based revision in a small experimental study. The word processor encouraged some students to see revision in more global terms, rather than soley in terms of lexical or grammatical correctness. For some of Bean's students, the word processor made a positive impact on their revising habits, though Bean made no formal analysis of changes in writing quality.

But evidence on how word processing effects revision strategies and overall writing quality is unclear. Collier (1983) found that better writers who developed facility with the word processor wrote better papers, while weaker writers, or those who could not develop a facility with the word processor,

wrote weaker essays. Yet in all cases, revision tended to stay on the surface level, with no significant changes on the global level, no text-based changes. While Collier was only working with four students, Gerrard (1982) obtained similar results with forty-four students. He felt, however, that students using the word processor worked longer on revision than when using pen and paper, though he did not formally time this feature, nor did he look at changes in writing quality.

Based on the general lack of empirical evidence, it seemed desirable to undertake a large-scale, ridgidly controlled study designed to analyze the effects of the word processor on writing quality. At the same time, it seemed appropriate to see if the word processor was influencing specific syntactic structures. Such a study would give valuable empirical data to writing teachers interested in incorporating the word processor into the composition classroom.

Research Questions

This study focused on changes in writing quality and syntax of first year college writers who are

taught to use the word processor as part of their English composition class. Two questions were addressed:

(1) Does using the word processor increase the syntactic growth of first year college composition students?

(2) Does using the word processor influence the holistic writing quality of first year college writers?

Method

Subjects

Two hundred out of a possible sixteen hundred first year composition students at Indiana University of Pennsylvania participated in this study. Of this first year class, only 1445 had SAT scores, the rest of the students being veterans, older returning students, or students with a GED, who were not required to have an SAT score. The mean SAT verbal score for the rest of the first year class on the main campus, where the study was conducted, was 490, compared to a national average of 426 and the Pennsylvania average of 425. A small portion of the first year class is exempted from English 101 through

placement testing, and another small portion of the class, those with severe writing problems, are tracked into English classes for basic writers.

Design

This study employed a randomized comparison group design using eight sections of composition. Four sections were taught word processing as part of writing instruction, and four sections were given only writing instruction. The study was conducted during the fall semester of 1984, the semester that most first year students take the required first semester writing course. At the beginning of the study, there were 100 students in the word processing sections and 100 students in the handwriting sections.

Procedure

After collecting pretest writing samples, all of which were written with pen and paper, students were randomly assigned to either a word processing section or a handwriting section. Class times were arranged so that a handwriting section was always meeting during the same hour that a word processing section was meeting. To minimize the effects of time of instruction, all eight sections were taught in the

morning, with each instructor teaching one section of one type followed by a section of the other. (See Table 1.) Each instructor knew the importance of teaching both the handwriting and word processing sections in an identical manner, but none of the four instructors was given any hypotheses about expected results.

Table 1

Teaching Assignments

	Instructor			
	1	2	3	4
8am	W	H		
9am	H	W	W	H
10am			H	W

W = word processing H = handwriting

Four experienced instructors of college composition agreed to teach one each of the word processing and the handwriting sections. (See Table 1.)

The four instructors asked to participate in this study were selected because their normal

classroom pedagogy embodied the best elements of teaching writing based on recent theory and research in the discipline. Hence, both the students using the word processor and the students writing with pen and paper were working in an optimal classroom situation, a situation where positive support, encouragement, and feedback were main features of the classroom.

Instruction was based on the theoretical position that at the heart of good writing is a knowledge about and an opportunity to do revision. Such a position is supported by substantial research into the role of revising in the composing process of all good writers (Beach, 1976, 1979; Gentry, 1980; Murray, 1976; Nold, 1979; Perl, 1979; Sommers, 1982), a position summarized by Britton et al. (1975) when they write, "Great writers and teachers of composition agree about very little, but a large portion of both are fiercely insistant on the need for very careful revision" (p. 46). Therefore, class instruction in this study centered on teacher-student conferencing, based on the evidence that such a pedagogy fosters revision processes that lead to improved writing quality (Clifford, 1981; Elbow,

1973; Irmscher, 1979; Macrorie, 1980; Moffett, 1968). Insofar as possible, the only difference between the handwriting sections and the word processing sections was that the handwriting sections wrote with pen and paper while the word processing sections wrote on the word processor.

Measures

Data were collected from writing samples taken before and after instruction (Sanders & Littlefield, 1975), because most theorists believe a direct sample is the best way to measure writing ability (Cooper, 1975, 1977; Diederich, 1974). Two writing samples were taken from each subject in the first days of the semester, before instruction began, and two samples were taken at the end of the semester, after instuction was completed.

Writing sessions were run identically for both the pretest and the posttest. Students received the writing task two days before they had to write, thus giving them the opportunity to think about the topic prior to the initial 60 minute writing session. Students were also alloted a 60 minute revising session two days after they completed their initial drafts.

The importance of student involvement in a writing task has been noted by researchers such as Emig (1971), Pianko (1977), and Sanders and Littlefield (1975). Bridwell (1979/1980) writes that giving students time to engage in thinking about a writing task before doing the actual assignment seemed to increase involvement on the part of the students. And Emig and Pianko have both suggested that giving students more than just one class period to complete a writing task may lead to more revision, and by implication, a higher quality of writing.

Fifty subjects were randomly selected from the handwriting sections and fifty from the word processing sections and their writing samples analyzed to produce the data for this study. As guides to educational research point out, the pretest-posttest design is an excellent way to determine effects of an educational treatment (Bloom, Hastings, & Madaus, 1971; Campbell & Stanley, 1963; Cronbach, 1963).

Students wrote two pieces of transactional prose for both the pretest and posttest writing sample. Transactional writing was chosen because as Britton et al. (1975) point out, 63.4% of secondary school-

sponsored writing is transactional, a percentage that increases when students enter college (Williamson, 1984). The writing tasks were randomized so that each student would write one explanatory and one persuasive essay at the beginning of the semester and a different explanatory and persuasive essay at the end of the semester.

Syntactic Analysis

To determine if using the word processor influenced the syntax of students in any significant way compared to students who wrote with pen, eighteen syntactic variables were analyzed in the writing samples. The variables analyzed were: total number of words, total T-units, average number of words per T-unit, total number of clauses, average number of words per clause, average number of clauses per T-unit, number of left branching free modifiers, number of words in left branching free modification, percent of words in left branching free modification, number of right branching free modifiers, number of words in right branching free modification, percent of words in right branching free modification, number of medial embeddings, number of words in medial

modification, percent of words in medial modification, total number of free modifiers, total number of words in free modification, and percent of words in free modification. These analyses were based on work by Christensen (1967), Hartwell (1982), Hunt (1965), Kline and Memering (1977), O'Donnell (1976), O'Hare (1973), and McAndrew (1982).

Quality ratings

Raters for the holistic scoring sessions were graduate students in the Rhetoric and Linguistics program at Indiana University of Pennsylvania, and all volunteered to participate. All papers to be evaluated were typed on a word processor so that handwriting would not be a factor in the evaluation (Markham, 1976), and so word processing sections could not be identified. Papers were also randomly mixed so that it was impossible for the raters to know whether they were reading papers written at the beginning or end of the semester, or whether papers came from handwriting or word processing sections.

Rating sessions began with a training period of approximately one hour conducted by an associate professor in the Rhetoric and Linguistics program at

IUP and an experienced trainer for holistic scoring sessions. There were two raters for each writing task, plus a third rater to arbitrate scores where the original raters disagreed by more than one point. Table 2 presents the data on inter-rater reliability for the holistic scoring of the writing samples.

Table 2

Inter-rater Reliability of Holistic Scorers

Task	Reliability
A	.83
B	.80
C	.80
D	.84
E	.75
F	.82

Results

Syntactic fluency

There were no significant differences in words per t-unit, words per clause, and clauses per t-unit

between handwriters and word processors. Neither were there significant differences in the mean number of words in right, left, medial, or total free modification. While there were some statistically significant changes in the rate of left branching free modification, it was quite small in terms of actual number of words, and appears in both the handwriting and word processing sections. This finding seems to be a manifestation of typical student writing found by Faigley (1979)--that freshmen composition students write considerably more left branching modifiers than do skilled adult writers.

Significant length variables were found in total words and, of course, total t-units. Viewing the main effect for method of writing, the significance test indicates that the changes from the two pretests, totaled, to the two posttests, totaled, are significantly different for word processing and handwriting, $F(1, 92) = 20.394$, $p < .0001$, (See Table 4.), with the students using word processors producing a mean of 303 more words across the two writing tasks than the hand writing students (Table 3).

Table 3

The Mean Number of Words Written Pretest and Posttest

	Method of Writing								
	Word processing			Handwriting			Teacher totals		
T	Pre	Post	Diff	Pre	Post	Diff	Pre	Post	Diff
A	678	1090	412	641	846	205	659	968	309
B	601	960	359	619	679	60	610	820	210
C	681	1068	387	710	768	58	695	918	223
D	674	1049	375	682	664	-18	678	856	178
	659	1042	383	663	739	76	Method Totals		

Table 4

Significance Tests for Pretest to Posttest Change for Total Words

Source	df	F
Time	1	55.799 *
Method by Time	1	20.394 **
Teacher by Time	3	.842
Method by Teacher by Time	3	.369

* $p < .01$ ** $p < .0001$

The analysis of change in total T-units (Table 5) shows that the word processing students began the semester with a lower mean total of T-units than did the handwriting students. But, by the end of the semester, word processing students increased their mean number of T-units by 24.48 while the handwriting students had increased their mean number of T-units by only 6.16. Significance tests are presented in Table 6.

Table 5

Mean Number of T-units per Essay

	Time		
Method of Writing	Pretest	Posttest	Change
Word Processing	40.09	64.57	24.48
Handwriting	45.51	51.67	6.16

Table 6

Significance Tests for Pretest to Posttest Changes in Total-T-units

Source	df	F
Time	1	62.19507 *
Method by Time	1	16.21539 **
Teacher by Time	3	1.96324
Method by Teacher by Time	3	.86396

* $p < .01$ ** $p < .0001$

Writing Quality

Table 7 presents the pretest and posttest means for the change in writing quality by method of writing. These differences were found to be significant, $F(1, 92) = 18.76418$, $p < .0001$. Even though the word processing sections began the semester with a lower mean quality score compared to the handwriting sections, by the end of the semester, the word processing sections had surpassed the handwriting sections in a combined mean score of overall writing quality.

Table 7

Analysis of Writing Quality Change Pretest to Posttest by Method of Writing

	Time		
Method	Prestest	Posttest	Change
Word processing	8.78	11.58	2.80
Handwriting	10.66	11.20	.54

There were no significant differences from pretest to posttest for the interaction of method and teacher, $F(3, 96) = 2.56034$, $p = .060$, and teacher

main effect, $F(3, 96) = 2.02290$, $p = .116$. For the significance texts, the total degrees of freedom is based upon a sample size of 100, but the sample size was reduced to 96 because scores for four subjects, two handwriters and two word processors, were incomplete. (Table 8)

Table 8

Tests of Significance for Quality of Writing

Source	df	F
Time	1	42.34878 *
Method by Time	1	19.38942 **
Teacher by Time	3	2.02290
Method by Teacher by Time	3	2.56034

* $p < .01$ ** $p < .0001$

Discussion

The most important question this study sought to answer was whether using a word processor in a composition course has significant impact on the overall writing quality of first year college students. Based on the evidence of a large sample

population, the answer is an unqualified yes. Though all students were taught under pedagogical conditions as nearly identical as possible, word processing students had a mean pretest to posttest gain in overall writing quality of 2.8 points, while handwriting students had a gain of only .54. Thus, the word processing students' gain in holistic quality was more than five times that of handwriters. It should be noted, however, that these gains were achieved in a process centered classroom, where students were asked to develop and expand their understanding of the writing process within the context of teacher-student conferencing.

We now have large-scale empirical evidence for what has been less formally observed by earlier investigators (Cottey, 1982; Macgregor, 1982; Portch & Breininger, 1983; Southwell, 1983; Papert, 1980; Barber, 1982). The recent statement by Sommers and Collins (1985) that ". . . not a single bit of research tells us yet that writing quality improves when word processing is used for instruction purposes" (p. 34) is no longer valid.

As already noted, word processing students made far greater gains in total words (and total T-units)

than did the handwriters. Not surprisingly, quality was directly related to length of essays. It is not certain what to attribute this greater length to, but there are at least two possibilities. One possible reason for greater length is the ease of writing and revising on the word processor. A second possibility may simply be the fun of using the word processor. The word processor seems to encourage the production of more text than does a pen and paper.

What constituted this greater length on the part of students using the word processor was not the subject of this study, but it would be interesting to know the answer. There appear to be two possibilities. Students may be dealing in greater depth with their ideas, or students may be producing a greater number of ideas. Of course, further research may find the answer to be a combination of the two.

Other syntactic variables, such as use of free modification, were not affected. But free modification was not taught as a central part of the pedagogy as suggested by Christensen (1967) and others, nor was sentence-combining a part of the pedagogy, so this result is not surprising.

It should be emphasized that writing instruction for students in this study was based on theory and research that suggests conferencing is a powerful pedagogical tool for helping students master the print code. This study gives evidence that conferencing, particularly when combined with word processing, encourages first year college students to write more, and more effectively than they normally would when using pen and paper. The results of this study suggest that the word processor offers first year college composition students a positive advantage in improving writing quality over the traditional method of handwriting.

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